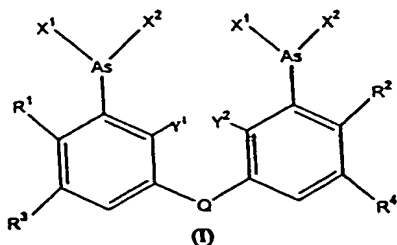


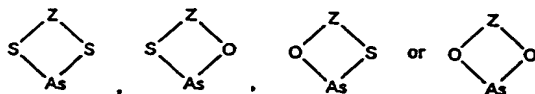
# Claims

What is claimed is:

1. A biarsenical molecule of the formula:

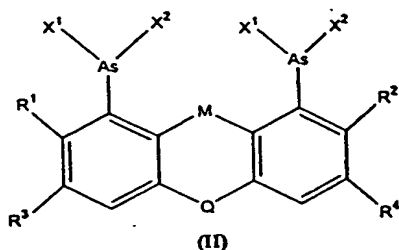


- 5 and tautomers, anhydrides, and salts thereof;  
wherein:  
each X¹ or X², independently, is Cl, Br, I, OR<sup>a</sup>, or SR<sup>a</sup>,  
or  
X¹ and X² together with the arsenic atom form a ring having  
10 the formula



- R<sup>a</sup> is H, C<sub>1</sub>-C<sub>4</sub> alkyl, CH<sub>2</sub>CH<sub>2</sub>OH, CH<sub>2</sub>COOH or CN;  
Z is 1,2-ethanediyl, 1,2-propanediyl, 2,3-butanediyl, 1,3-  
propanediyl, 1,2 benzenediyl, 4-methyl-1,2-benzenediyl, 1,2-  
15 cyclopentanediyl, 1,2-cyclohexanediyl, 3-hydroxy-1,2-  
propanediyl, 3-sulfo-1,2-propanediyl, or 1,2-bis(carboxy)-  
1,2-ethanediyl;  
Y¹ and Y², independently, are H or CH<sub>3</sub>;  
or  
20 Y¹ and Y², together form a ring such that the biarsenical

molecule has the formula



where M is O, S, CH<sub>2</sub>, C(CH<sub>3</sub>)<sub>2</sub>, or NH;

R<sup>1</sup> and R<sup>2</sup>, independently, are OR<sup>a</sup>, OAc, NR<sup>a</sup>R<sup>b</sup>, or H;

5 R<sup>3</sup> and R<sup>4</sup>, independently, are H, F, Cl, Br, I, OR<sup>a</sup>, or R<sup>a</sup>;

or

R<sup>1</sup> together with R<sup>3</sup>, or R<sup>2</sup> together with R<sup>4</sup>, or both, form a ring in which

10 (i). one of R<sup>1</sup> or R<sup>3</sup> is C<sub>2</sub>-C<sub>3</sub> alkyl and the other is

NR<sup>a</sup> and

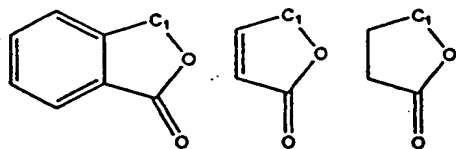
(ii). one of R<sup>2</sup> and R<sup>4</sup> is C<sub>2</sub>-C<sub>3</sub> alkyl and the other is

NR<sup>a</sup>;

R<sup>b</sup> is H, C<sub>1</sub>-C<sub>4</sub> alkyl, CH<sub>2</sub>CH<sub>2</sub>OH, CH<sub>2</sub>COOH, or CN;

Q is CR<sup>a</sup>R<sup>b</sup>, CR<sup>a</sup>OR<sup>b</sup>, C=O, or a spirolactone having the

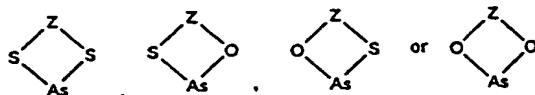
15 formula:



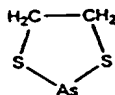
wherein the spiro linkage is formed at C<sub>1</sub>.

2. The molecule of claim 1, wherein said X<sup>1</sup> and X<sup>2</sup> together with the arsenic atom form a ring having the

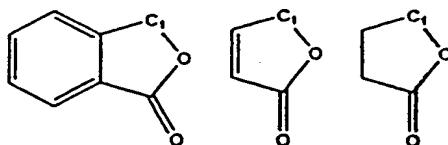
20 formula



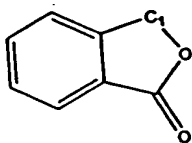
3. The molecule of claim 1, wherein said  $X^1$  and  $X^2$  together with the arsenic atom form a ring having the formula



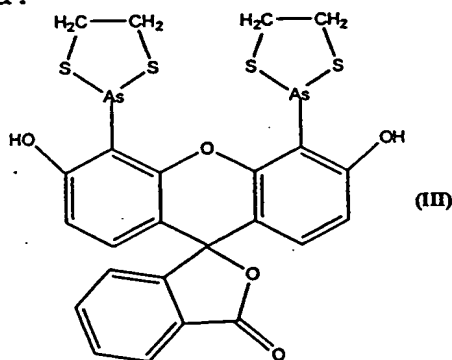
5 4. The molecule of claim 1, wherein Q is a spirolactone having the following formula:



5. The molecule of claim 1, wherein Q is



10 6. The molecule of claim 1, wherein said molecule has the following formula:



and tautomers, anhydrides, and salts thereof.

7. The molecule of claim 1, wherein said molecule  
15 specifically reacts with a target sequence to generate a detectable signal.

8. The molecule of claim 1, wherein said molecule specifically reacts with a target sequence to generate a fluorescent signal.

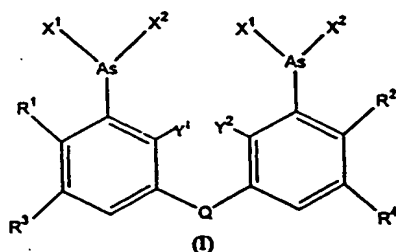
9. The molecule of claim 1, wherein said molecule is capable of traversing a biological membrane.

10. The molecule of claim 1, wherein said molecule is substituted at one or more positions with a detectable group.

11. The molecule of claim 10, wherein said detectable group is a fluorescent group.

12. The molecule of claim 1, wherein said molecule is coupled to a solid phase.

13. A kit comprising  
a. a biarsenical molecule of the formula:

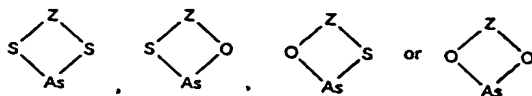


and tautomers, anhydrides, and salts thereof;  
wherein:

each X<sup>1</sup> or X<sup>2</sup>, independently, is Cl, Br, I, OR<sup>a</sup>, or SR<sup>a</sup>,  
or

X<sup>1</sup> and X<sup>2</sup> together with the arsenic atom form a ring having

the formula



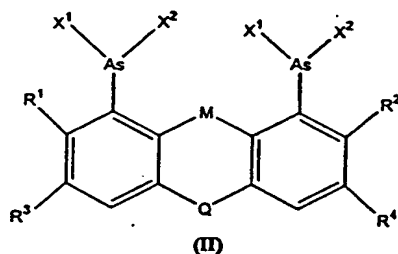
$R^a$  is H,  $C_1$ - $C_4$  alkyl,  $CH_2CH_2OH$ ,  $CH_2COOH$ , or CN;

Z is 1,2-ethanediyl, 1,2-propanediyl, 2,3-butanediyl, 1,3-propanediyl, 1,2 benzenediyl, 4-methyl-1,2-benzenediyl, 1,2-cyclopentanediy, 1,2-cyclohexanediy, 3-hydroxy-1,2-propanediyl, 3-sulfo-1,2-propanediyl, or 1,2-bis(carboxy)-1,2-ethanediyl;

$Y^1$  and  $Y^2$ , independently, are H or  $CH_3$ ;

or

$Y^1$  and  $Y^2$ , together form a ring such that the biarsenical molecule has the formula



where M is O, S,  $CH_2$ ,  $C(CH_3)_2$ , or NH;

$R^1$  and  $R^2$ , independently, are  $OR^a$ , OAc,  $NR^aR^b$ , or H;

$R^3$  and  $R^4$ , independently, are H, F, Cl, Br, I,  $OR^a$ , or  $R^a$ ;

or

$R^1$  together with  $R^3$ , or  $R^2$  together with  $R^4$ , or both, form a ring in which

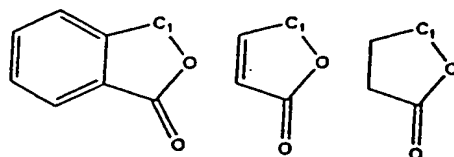
(i). one of  $R^1$  or  $R^3$  is  $C_2$ - $C_3$  alkyl and the other is  $NR^a$  and

(ii). one of  $R^2$  and  $R^4$  is  $C_2$ - $C_3$  alkyl and the other is  $NR^a$ ;

$R^b$  is H,  $C_1$ - $C_4$  alkyl,  $CH_2CH_2OH$ ,  $CH_2COOH$  or CN;

Q is  $CR^aR^b$ ,  $CR^aOR^b$ , C=O, or a spirolactone having the

formula:



wherein the spiro linkage is formed at C<sub>1</sub>; and

- b. a bonding partner comprising a target sequence,  
5 said target sequence comprising one or more cysteines  
capable of specifically reacting with said biarsenical  
molecule.

14. The kit of claim 13, wherein said target sequence  
comprises four cysteines.

- 10 15. The kit of claim 13, wherein said target sequence  
comprises a Cys-Cys-X-Y-Cys-Cys sequence, wherein said X and  
Y are amino acids.

16. The kit of claim 15, wherein said X and Y are amino  
acids with high alpha-helical propensity.

- 15 17. The kit of claim 15, wherein said X and Y are the  
same amino acid.

18. The kit of claim 15, wherein said X and Y are  
different amino acids.

19. The kit of claim 13, wherein said target sequence is  
20 selected from the group consisting of SEQ ID NO. 1. and SEQ  
ID NO. 4.

20. The kit of claim 13, wherein said bonding partner further comprises a carrier molecule.

21. The kit of claim 13, wherein said bonding partner further comprises a carrier polypeptide.

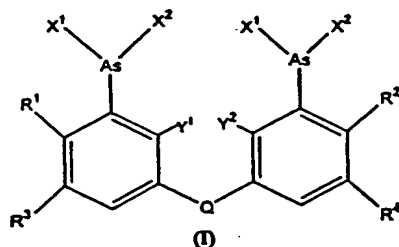
5 22. The kit of claim 21, wherein said target sequence is heterologous to said carrier polypeptide.

23. The kit of claim 13, wherein said biarsenical molecule specifically reacts with said target sequence and generates a detectable signal.

10 24. The kit of claim 23, wherein said detectable signal is a fluorescent signal.

25. A kit comprising

a. a biarsenical molecule comprising the following formula:



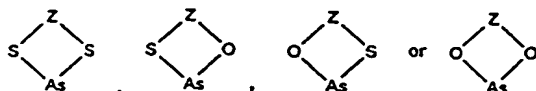
and tautomers, anhydrides, and salts thereof;

wherein:

each X¹ or X², independently, is Cl, Br, I, OR<sup>a</sup>, or SR<sup>a</sup>,

or

20 X¹ and X² together with the arsenic atom form a ring having the formula



$R^a$  is H,  $C_1-C_4$  alkyl,  $CH_2CH_2OH$ ,  $CH_2COOH$  or CN;

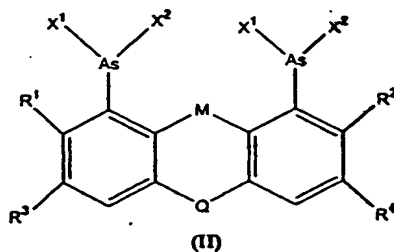
Z is 1,2-ethanediyl, 1,2-propanediyl, 2,3-butanediyl, 1,3-propanediyl, 1,2 benzenediyl, 4-methyl-1,2-benzenediyl, 1,2-cyclopentanediy, 1,2-cyclohexanediy, 3-hydroxy-1,2-propanediyl, 3-sulfo-1,2-propanediyl, or 1,2-bis(carboxy)-1,2-ethanediyl;

$Y^1$  and  $Y^2$ , independently, are H or  $CH_3$ ;

or

$Y^1$  and  $Y^2$ , together form a ring such that the biarsenical

molecule has the formula



where M is O, S,  $CH_2$ ,  $C(CH_3)_2$ , or NH;

$R^1$  and  $R^2$ , independently, are  $OR^a$ , OAc,  $NR^aR^b$ , or H;

$R^3$  and  $R^4$ , independently, are H, F, Cl, Br, I,  $OR^a$ , or  $R^a$ ;

or

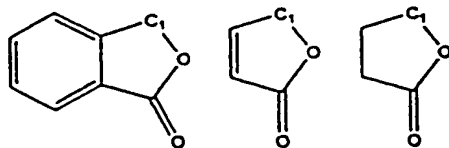
$R^1$  together with  $R^3$ , or  $R^2$  together with  $R^4$ , or both, form a ring in which

(i). one of  $R^1$  or  $R^3$  is  $C_2-C_3$  alkyl and the other is  $NR^a$  and

(ii). one of  $R^2$  and  $R^4$  is  $C_2-C_3$  alkyl and the other is  $NR^a$ ;

$R^b$  is H,  $C_1-C_4$  alkyl,  $CH_2CH_2OH$ ,  $CH_2COOH$  or CN;

Q is  $CR^aR^b$ ,  $CR^aOR^b$ ,  $C=O$ , or a spirolactone having the formula:





wherein the spiro linkage is formed at C<sub>1</sub>; and

5        b. a vector comprising a nucleic acid sequence encoding a target sequence, said target sequence comprising one or more cysteines capable of specifically reacting with said biarsenical molecule.

26.        The kit of claim 25, wherein said target sequence comprises four cysteines.

10        27.        The kit of claim 25, wherein said target sequence is selected from the group consisting of SEQ ID NO. 1. and SEQ ID NO. 4.

28.        The kit of claim 25, wherein said vector further comprises a nucleic acid sequence encoding a carrier polypeptide.

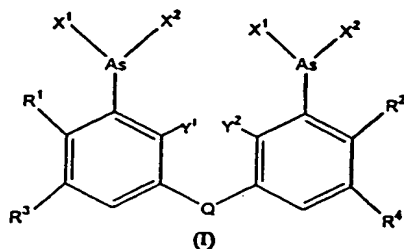
15        29.        The kit of claim 28, wherein said carrier polypeptide is heterologous to said target sequence.

30.        The kit of claim 25, wherein said biarsenical molecule specifically reacts with said target sequence and generates a detectable signal.

20        31.        The kit of claim 30, wherein said detectable signal is a fluorescent signal.

32.        A complex comprising a biarsenical molecule and a target sequence, said target sequence comprising one or more cysteines capable of reacting with said biarsenical molecule, said biarsenical molecule having the following

formula:



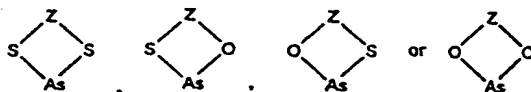
and tautomers, anhydrides, and salts thereof;

wherein:

5 each  $X^1$  or  $X^2$ , independently, is Cl, Br, I,  $OR^a$ , or  $SR^a$ ,

or

$X^1$  and  $X^2$  together with the arsenic atom form a ring having the formula



10  $R^a$  is H,  $C_1-C_4$  alkyl,  $CH_2CH_2OH$ ,  $CH_2COOH$  or CN;

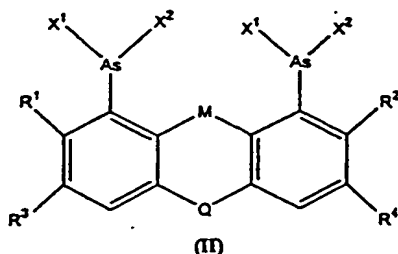
Z is 1,2-ethanediyl, 1,2-propanediyl, 2,3-butanediyl, 1,3-propanediyl, 1,2 benzenediyl, 4-methyl-1,2-benzenediyl, 1,2-cyclopentanediy, 1,2-cyclohexanediy, 3-hydroxy-1,2-propanediyl, 3-sulfo-1,2-propanediyl, or 1,2-bis(carboxy)-

15 1,2-ethanediyl;

$Y^1$  and  $Y^2$ , independently, are H or  $CH_3$ ;

or

$Y^1$  and  $Y^2$ , together form a ring such that the biarsenical molecule has the formula



20

where M is O, S, CH<sub>2</sub>, C(CH<sub>3</sub>)<sub>2</sub>, or NH;

R<sup>1</sup> and R<sup>2</sup>, independently, are OR<sup>a</sup>, OAc, NR<sup>a</sup>R<sup>b</sup>, or H;

R<sup>3</sup> and R<sup>4</sup>, independently, are H, F, Cl, Br, I, OR<sup>a</sup>, or R<sup>a</sup>;

or

- 5 R<sup>1</sup> together with R<sup>3</sup>, or R<sup>2</sup> together with R<sup>4</sup>, or both, form a ring in which

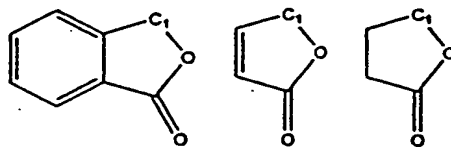
(i). one of R<sup>1</sup> or R<sup>3</sup> is C<sub>2</sub>-C<sub>3</sub> alkyl and the other is NR<sup>a</sup> and

(ii). one of R<sup>2</sup> and R<sup>4</sup> is C<sub>2</sub>-C<sub>3</sub> alkyl and the other is

- 10 NR<sup>a</sup>;

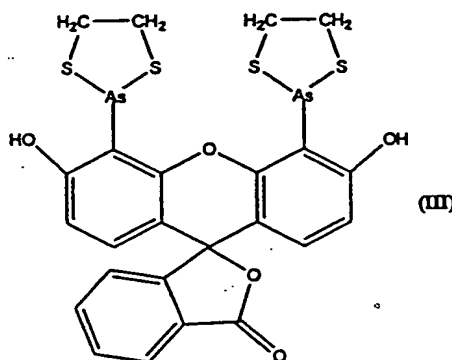
R<sup>b</sup> is H, C<sub>1</sub>-C<sub>4</sub> alkyl, CH<sub>2</sub>CH<sub>2</sub>OH, CH<sub>2</sub>COOH or CN;

Q is CR<sup>a</sup>R<sup>b</sup>, CR<sup>a</sup>OR<sup>b</sup>, C=O, or a spirolactone having the formula:



- 15 wherein the spiro linkage is formed at C<sub>1</sub>.

33. The complex of claim 32, wherein said biarsenical molecule is



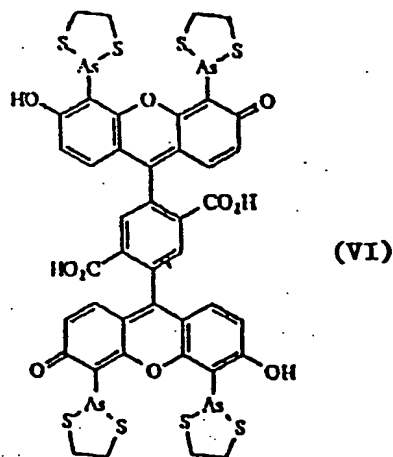
and tautomers, anhydrides and salts thereof.

34. The complex of claim 32, wherein said target sequence comprises four cysteines.

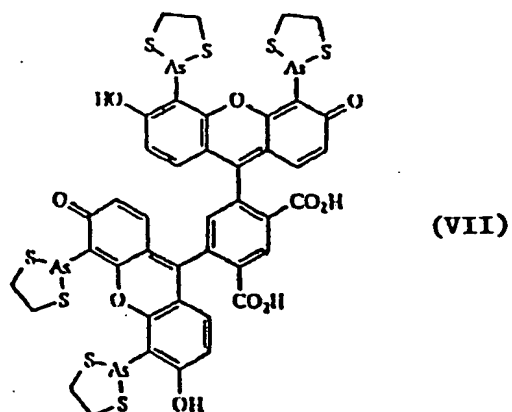
35. The complex of claim 32, wherein said target sequence is selected from the group consisting of SEQ ID NO. 1 and SEQ ID NO. 4.

36. A tetraarsenical molecule comprising two biarsenical molecules according to claim 1 coupled to each other through a linking group.

37. The tetraarsenical molecule of claim 36, said molecule having the formula



38. The tetraarsenical molecule of claim 36, said molecule having the formula



39. The tetraarsenical molecule of claim 36, said molecule having the formula

